Land Degradation & Development Group

Constraints and opportunities for the implementation of Conservation Agriculture in the highlands of Vakinankaratra, Madagascar

MSc Thesis by Maaike Hartog, draft

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Implementation of Conservation Agriculture in the highlands of Vakinankaratra, Madagascar

Master thesis Land Degradation and Development Group submitted in partial fulfillment of the degree of Master of Science in International Land and Water Management at Wageningen University, the Netherlands

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MSc International Land and Water Management (MIL)

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ABBREVIATIONS

AFD	Agence Française de Développement
BEST	?
BVPI	Projet de développement des Bassins Versants et Périmètres Irrigués
CA	Conservation Agriculture
CA2AFRICA	Conservation Agriculture in AFRICA: Analysing and Foreseeing its Impact - Comprehending its Adoption
CIRAD	Centre International de Recherche Agronomique pour le Développement or Centre de coopération internationale en recherche agronomique pour le développement
CIRAD CP : CIRAD département cultures pérennes	
DMC	Direct seeding mulch-based cropping systems (SCV in French)
FAO	Food and Agriculture Organization of the United Nations
FOFIFA	National Center for Research Applied to Rural Development
FOFIFA	National research centre for rural development at Antananarivo University
GSDM	Groupement Semis Direct de Madagascar
MAEP	Ministère de l'agriculture, de l'élevage et de la pêche
NGO	Non Governmental Organization
SDMAD	Semis Direct Madagascar
SCV	Semis Direct sous Couverture Végétale (DMC in English)
TAFA	Tany sy Fampandrosoana (soil and development)
UMR Innovation?	
URP SCRID	Unité de Recherche en Partenariat Systèmes de Culture et Rizicultures Durables

Angady	Malagasy digging stick with a blade at its end
Ariary	monnaie courante malgache : 1 Ariary = 5 Fmg et 1 euro = 2500 Ariary en Juillet 2007
Fokontany	Village
Sobika	Basket
Tanety	Hillside

1 INTRODUCTION

Madagascar, *la Grande Île*, is a place on earth with some most peculiar natural features. The current degraded status of its soils is unfortunately less unique. The vulnerable environment suffers from the increasing pressure of the growing population. Cropping on slopes causes erosion. Soil fertility is low, input needed. (Source, Douzet)

The concept of Conservation Agriculture (CA) has been introduced as the way to fight worldwide soil degradation and change mining agriculture into a more sustainable system. At this time, the concept is used on 6-7% of the world's cropland (FAO, 2009). The adoption rate among African smallholders has been very limited.

This is the starting point for the EU-project CA2AFRICA. It aims at examining the conditions that determine success or failure of CA (CA2AFRICA, 2009). The project uses three scales to analyze CA: field, farm/village and regional. This research is focused on the scale of farm and village.

This research focuses on the highlands in the region of Vakinankaratra. NGO's and scientists have undertaken activities to introduce CA, but so far the practices have not been implemented on a large scale in the highlands. The research has been carried out from June to September 2010.

This thesis starts with an introduction to the subject. After the problem and its context is described. The research methodology introduces the two chapters that contain results of the research: The theoretical synthesis and results of the survey. A discussion and conclusion form the final chapters.

2 RESEARCH CONTEXT

2.1 REGIONAL INFORMATION

2.1.1 LOCATION

The research takes place in Madagascar, an island-nation situated in the Indian Ocean. Vakinankaratra is a region of Madagascar (see figure 1). The choice for the study area was made on the basis of the administration of the BVPI-project, that defines its zones according to the irrigated perimeters (PI). For this research two zones were chosen: Fitakimerina and Iandratsay (both part of *Lot 1* of the project). This was done because of their proximity to the town of Antsirabe, and because of the low adoption rate of CA in these zones. There is a third zone that falls into this category: Ikabona, but it was not chosen because of the limited time.

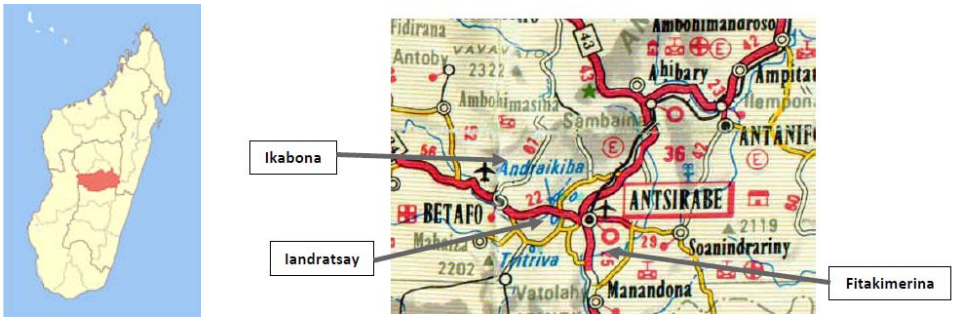

Figure 1: Location of Vakinankaratra (red) and study areas (Iandratsay and Fitakimerina), Source: CIRAD

After the region, the next administrative level is that of districts, which are divided into *communes*. The research is conducted in the *communes* Vaninkarena (district Antsirabe II) and Mandritsara (district Ikabona). The level that can be identified as 'village' is called *fokontany*. Because of the complicated structure and the difference between BVPI and Malagasy administration, this report refers to sublocations rather than *fokontany* or county. The following sublocations have been visited:

Location	Sublocation	Number of interviews
Fitakimerina (*commune* Vaninkarena)	Anjanamanjaka (BVPI: Ambohimanga&Ambohitraivo)	26
	Tsaratanana	4
Iandratsay (*commune* Mandritsara)	Ambohimarina (BVPI: Est Anosy)	20
	Ampamelomana	10

2.1.2 NATURAL FEATURES

The highlands of Vakinankaratra know a warm raining season from October/November to March/April. The winter season is dry and cold, from April/Mai to September. Figure 2 gives a general picture of the precipitation in this region. Table 1 presents natural features per location.

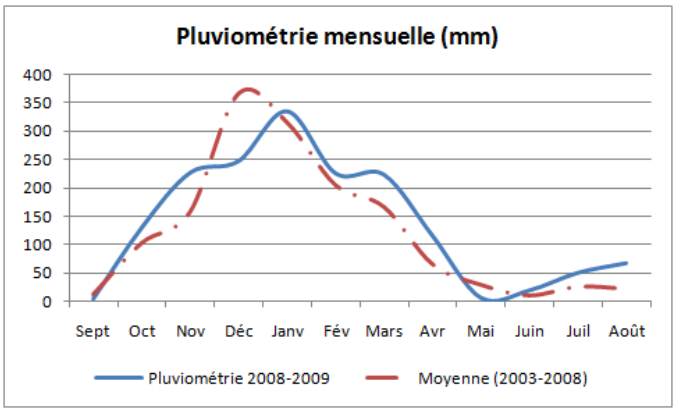

Figure 2 Monthly rainfall for 2003-2009, station Andranomalenatra-Kobama (Source: BVPI, 2009b)

Table 1 Natural features of study locations (Source: BVPI SE/HP, 2008a-c)

Location	Sublocation	Altitude (meter above sea level)	Soil types	Annual precipitation
Fitakimerina	Anjanamanjaka	1500	Hills: Acid ferralsol (pH 5.0), texture: sandy loam, poor in OM, very poor in P,Ca,Mg and K. Valleys: Deposit fluvio lacustre. Tsaratanana: Occurrence of hydromorph soil at flat *tanety*.	1200 mm, mainly in January and February
	Tsaratanana			
Iandratsay	Ambohimarina	1600*	Hills : Rich vulcanic and poor ferralsol. Valleys : Less rich.	1450 mm in 110 days (85% in November to March)
	Ampamelomana			

*) Estimation from GoogleEarth

2.1.3 SOCIO-ECONOMIC FEATURES

In 2007, the per-capita rice consumption in Madagascar was nearly 100 kg/year. Madagascar, Comoros and Tanzania, are mentioned as "the major rice-consuming nations in the world". In 2001-5 Madagascar produced 1,9 million kg of rice, it is cited as "apparently self-sufficient" in this staple crop. (WARDA, 2007)

Development in the past : Rice not sufficient any more (Seguy, 2003:4). Food crops (vivrière) versus cash crops (cultures de rente).

The city of Antsirabe plays an important role in this region. The highlands around the city supply food, especially dairy products, to its 159.000 inhabitants. Current problems of dairy sector, disturbance of market by Ravalomanana, political crisis.

Commentaire [M1]: I have not yet found any helpful articles that explain this..

Antsirabe is home to the brewery of STAR. This company buys barley from the farmers through an organisation called Malto. Farmers receive the right seeds and entrants, money that is extracted from the price they get for the harvested barley. Especially in Iandratsay, this is an important source of income.

At the studied locations, agriculture is the main economic activity. Three different seasons can be distinguished:

- Main season: From October (installation of rice) until March/April/Mai (harvest of rice)
- Inter season at *tanety*: From December (after beginning of the rains)
- Counter season at *bas fonds*: From March/April/Mai (harvest of rice) until October

During the inter season, most households have consumed all of their rice. This is the period in which most people buy rice, even if they have been selling rice at harvest time (for a lower price).

An important feature of the area is the difference between the *tanety* (hillsides) and the valleys. Rizières / Bassins versants/ bas fonds. (Rakotofiringa et al., 2007:26).

RMME Diagn terroir Fitakimerina: l'eau y est mal maîtriser (repiquage tardif pour la riziculture en mois de décembre et janvier). Le régime agricole fait que tout ce qui cultive en haut reçoive en premier l'eau et le reste ne bénéficie que tardivement. DT Iandr : des bas fonds inondés pendant la saison de pluie.

Cattle Le plus important pour ces paysans est d'avoir de troupeau de bovin. Les bovins contribuent largement au travail de culture ils sont destinés à la production des fumiers et des transport pour leur propre exploitation,

Work division between men/women

In Table 2, some data can be found per study location.

Table 2 Socio-economic features of study locations (Source: BVPI SE/HP, 2008a-c)

Location	Sublocation	Inhabitants	Presence of cows	Principal cultures	
				Tanety	Paddy's counter season
Fitakimerina	Anjanamanjaka	2000 (Ambohimanga)	25% of inhabitants possesses zebu.	In order of importance : Maize, beans, pluvial rice, sweet potato, cassava, bambara groundnut.	In order of importance : Potato, barley, wheat, peas, garlic.
	Tsaratanana	700			
Iandratsay	Ambohimarina	725*	65% of inhabitants possesses zebu, average of 3/household. Dairy cattle sporadic.	Main season: Maize, beans, soja, potato, rice.	Wheat, barley, taro, beans, maize for cows, tomato, ray grass, legumes, peas, potato.
	Ampamelomana	Not known			

*) Information from president of *fokontany*, 31-07-2010 (interview no 47)

The tenure status of most land is not legalized. At the location of Fitakimerina, 2/3 of the land is bought and 1/3 inherited. 50% of the farmers are hiring the land. (BVPI SE/HP, 2008a) In Iandratsay, most of the people are owners, be it unentitled (BVPI SE/HP, 2008b).

Apart from agriculture, the inhabitants have some opportunities to gain money off-farm. In Ambohimanga (Fitakimerina), sand is mined from the river. This activity is most important in the winter season, just like the fabrication of bricks. Other sectors are the hydraulic dam of Jirama (the electricity company) and construction of buildings. (BVPI SE/HP, 2008a) Several people also run a small shop or restaurant, or have a small revenue from handicraft from wheat residues (BVPI SE/HP, 2008b).

Table 3 Data from BVPI-database of Vakinankaratra, end of August 2010 (Source: BVPI SE/HP, 2010)

Location	Sublocation	Selected BVPI parameters	Number of people	Average total figures				
				surface exploited/p (ha)	surface paddy/p (ha)	number of 'boeuff de trait'	number of zebus	number of 'vache laitiere'
Fitakimerina	Anjanamanjaka	*Villages* Ambohimanga & Ambohitraivo	51	3,05	0,88	0,84	2,18	0,61
	Tsaratanana	*Village* Tsaratanana	34	1,22	0,22	0,44	0,64	0,12
Iandratsay	Ambohimarina	*Terroir* Est Anosy	102	1,03	0,27	2,24	1,73	1,64
	Ampamelomana	*Terroir* Ampamelomana	100	1,44	0,57	2,33	4,23	1,99

2.2 CONSERVATION AGRICULTURE

2.2.1 DEFINITION

The soils of the world are degrading and lose their fertility, partly as a result of conventional tillage practices. Negative effects of tillage are for example oxidation of organic matter (OM) and destruction of pores. The uncovered state of the soil after ploughing increases erosion risks. (Hobbs, 2007) Several authors (Hobbs, 2007; Fowler&Rockström, 2001) have indicated the need to make agriculture more sustainable. Sustainability is generally defined as a way of acting that does not "... compromise the ability of future offspring to produce their food needs by damaging the natural resources used to feed the population today." (Hobbs *et al*, 2008:543)

The alternative agricultural practices that are being developed, were by the Food and Agriculture Organization of the United Nations (FAO) considered as a package, and labelled as 'Conservation Agriculture'. These practices are:

1. Continuous minimum mechanical soil disturbance.
2. Permanent organic soil cover.
3. Diversification of crop species grown in sequence or associations.

(FAO, 2010)

It is aimed at making better use of the agricultural resources to minimize external inputs.

In a brochure by AFD (2007:28), a difference is made between CA and direct seeding mulch-based cropping systems (DMC). The latter term refers to cropping systems that include no tillage and permanent plant cover on the soil - be it with a living crop or dead mulch. In French, these techniques are called: *Système de Culture sur Couverture Végétale* (SCV). The concept of DMC was launched by CIRAD in 1999. It does not include crop rotation explicitly, but it still can be seen as a special form of CA. In this proposal, I consequently use the term 'CA practices' to refer to this particular package.

Commentaire [M2]: See AFD,2007:28: "DMC… this concept was launched by CIRAD in 1999…"

2.2.2 *Applicability of CA principles*

The promotion of Conservation Agriculture cannot take place without a critical reflection on the principles of these practices. If we take the plough as a metaphor, the paradigm shift that taken place has changed this object from a useful tool to a dangerous soil-destroyer. Gowing and Palmer (2008) call it a paradigm shift because CA requires a way of thinking that puts the health of the soil ecosystem first. From this way of thinking, tillage becomes disturbance of the soil and has very damaging effects.

The new paradigm includes a shift from mining agriculture to sustainable agriculture. Advocates of CA underline the importance of producing more food from less resources. (Hobbs *et al*, 2008)

The confidence of the FAO in promoting CA becomes clear in citations like: "The cases where CA did not perform as expected can usually be related to mistakes or shortcuts in the management of the system, but not to any inherent failures in the system." (FAO, 2009)

In a paper by Giller et al. (2009), it is posed that CA can be inappropriate in many cases. It places a heavy burden on the livestock feeding, since crop residues are normally used for fodder. Another issue is the shift of labour from ploughing (men's work) to hand weeding (mostly done by women).

Giller et al. (2009) also point to the fact that CA is brought as a 'inseparable' package. It is not clear what the effect of mulching is, when practiced apart from the minimum-tillage. Rabary et al. (2008) admit that their study was also unable to isolate this effect. However, they add that mulching and conventional tillage is a combination that is not commonly practiced.

Literature on question: Is CA appropriate for poor smallholders? (High investments and risks in first years). If possible: table.

Commentaire [M3]: I still have not found specific articles on this topic.

To know if the principles of CA are applicable for this particular situation, the highlands of Madagascar, the pros and cons need to be profoundly analyzed. The following chapters will elaborate on this.

2.3 Adoption of Conservation Agriculture

2.3.1 *Definition*

The process of adoption has been studied since the first extension services encountered their first disappointing results. With adoption I mean the phase where a farmer makes effort and invests in the implementation of conservation agriculture. De Graaff et al. (2008) distinguish between three phases: acceptance, actual adoption and continued use. This last phase is the term that I use for implementing CA without intensive supervision/sponsoring by a project. It indicates that farmers are

intrinsically motivated to maintain and replicate the CA measures. The final phase can only be achieved when farmers have experience with the measures, it requires time.

2.3.2 FACTORS INFLUENCING ADOPTION

Many different factors can be thought of when studying the behaviour of farmers as they decide about adoption or non-adoption. But it is important to note that it is not a black-or-white decision. The intensity of implementation is important to distinguish between trials and actual adoption. Farmers also do not adopt a blueprint that is determined for them, they often adapt the measures to their own situation (de Graaff et al., 2008).

A research on farmer innovation in East Africa concluded that an increase in income is the most important motivation to innovate. In this context, the author refers to what he calls the "new 'received wisdom' in soil conservation circles": Investments in conservation measures are stronger motivated by gains in production (read: income, standard of living) than by environmental concerns. (Critchley, 1999:44-5)

The research of Clay *et al* (1998), in the highlands of Rwanda, found that the following features were positively related to investments in land conservation: land that is owned, has a medium slope, is less fragmented and is cultivated for a shorter time, and among smaller farmers and those with little land in fallow, woodlot, and pasture. An off-farm income also stimulates these investments, because it provides money, especially when households have little access to credit. The same can be said from cash cropping. Lastly, this research mentions public investments in extension and roads to promote sustainable intensification.

Apart from these resources, a lot more research has been done on the factors that influence farmers' decisions. Knowler and Bradshaw (2007) wrote a synthesis of recent research. The analyses that they compared, covered a range of economic, social, physical and institutional factors. The authors conclude that "there are few if any universal variables that regularly explain the adoption of conservation agriculture". The observation that the results of these analyses are so inconsistent, points to the importance of local management.

3 PROBLEM DESCRIPTION

The current dead-lock that the implementation of CA practices seems to reach, can lead to a global failure of dissemination. This is why it is important to know the reasons why farmers in Vakinankaratra are not using the CA practices (as defined in SCV) that were suggested to them, both in the past and in the present time.

Commentaire [M4]: I have not found BVPI-data that show adoption rates for SCV? Eg how many farmers are practising SCV per Lot/Terroir.

3.1 RESEARCH QUESTIONS

What are the past and present reasons why farmers are hesitant to adopt (certain) CA practices in the highlands of Vakinankaratra?

Sub-questions

1. What were the most important roles of the different development organizations (including research) in the highlands of Vakinankaratra in the past, concerning the adoption of CA practices?
2. What are the past and present reasons* why farmers are hesitant to adopt (certain) CA practices in the highlands of Vakinankaratra? (with special attention to adoption of the particular system that has potential for the area)

*There are roughly two groups of reasons: Those that can be influenced by farmers and those that cannot (circumstances like climate). These two things strongly interact with each other.

3.2 CONTRIBUTION OF THIS RESEARCH

This thesis is part of the research project described above. The choice of the location has been made by E. Penot, according to the project demand and the other research activities concerning CA evaluation in other areas. A lot of research has been done in this region by FOFIFA (the national research centre for rural development at Antananarivo University) and CIRAD (Unité de Recherche en Partenariat Systèmes de Culture et Rizicultures Durables in particular as well as UMR Innovation) including associated NGO's such as TAFA (Tany sy Fampandrosoana, Soil and Development). The features of agricultural activities have been intensively studied, together with the opportunities and threats for CA practices. SCRID is still searching for CA systems adapted to local conditions. This research hopes to contribute to that quest.

This study focuses on the process that led to the current situation, both from the side of the providing organizations and the side of farmers. It will not go into detail about technical aspects of the measures. Some attention will also be given to the gender aspect of transferring CA practices.

4 METHODOLOGY

Part of the research objective is to understand how CA practices have been introduced from the side of development organizations. I will look for the opinions of researchers and personnel of the organizations that have experience in the region. The other part is about the farmers. I want to start from the point of view of a farmer instead of reasoning from a package of measures that should be implemented. This is why I avoid the term 'constraints'. I will try to interview the person who made this decision, be it the man or the woman of the family.

4.1 THEORETICAL EXPLORATION

To answer the first research question and formulate hypotheses for the second, I have studied literature and interviewed key informants. Papers from CIRAD and TAFA were used for a historical oversight.

I have met the following persons:

Eric Denis	Julie Dusserre	Roger Michellon	Judi Cael	Olivier Husson
Tahina Raharison	Mathilde Sester		Gabriel Morin	
Andry Rarivoharison	Eric Scopel			
	Eric Penot			
	Krishna Naudin			

The result of this theoretical part can be found in chapter 5: Theoretical synthesis.

4.2 SURVEY UNDER FARMERS

The empirical part of the research consisted of a survey under 60 farmers. During the interviews I have lived in the villages. This paragraph will explain the way the sample was determined and choices that were made in treating the data.

4.2.1 JUSTIFICATION OF CHOSEN SAMPLE

Randrianarison et al. (2007:25) created a typology with six different types for the *fokontany* Antsapanimahazo:

1. Farmers that have never tried CA;
2. Farmers who abandoned CA after 1 or 2 years;
3. Farmers who abandoned CA after 3 or 4 years;
4. Farmers who abandoned CA after more than 5 years;
5. Farmers practising CA for 1 or 2 years;
6. Farmers practising CA for 3 years or more.

In this typology, farmers of type 5 are called 'experimental adopters' and those of type 6 'real adopters'. Type 4 was created because these farmers have distinguished reasons for abandoning. Most farmers in the *fokontany* belong to type 1.

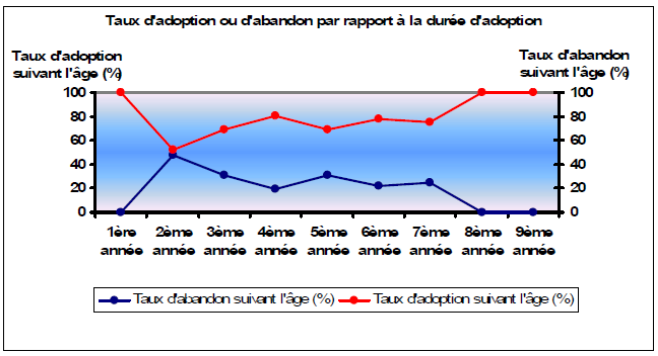

Figure 3: Percentages of adoption/abandoning of CA in relation to years practiced, in Antsapanimahazo (Source: Randrianarison, 2007)

If farmers have never been into contact with CA practices, they have not yet been in a position to choose. These farmers are not very useful to this research.

The first level of determining the sample consists of three groups:

1. Those that have never tried CA;
2. Those that have abandoned CA after some time (how much time?)
3. Those that are still practising CA

The second level is made up of the parameters in table 1. This is done to be representative, while knowing that a small sample like this will of course never succeed to be very representative. For each group, the research has aimed at the sample in table 2.

Table 4 Parameters, according to BVPI-database of Vakinankaratra, 10 June 2010 (Source: BVPI SE/HP, 2010)

	Total	exploitation < 4 ha	Size unknown	>1 dairy cow *	Unknown number cows*	Women	Sex unknown
Number Fitakimerina	89	68	14	14	19	32	7
Percentage Fitakimerina	100%	76%	16%	16%	21%	36%	8%
Number Iandratsay	370	307	49	73	281	69	48
Percentage Iandratsay	100%	83%	13%	20%	76%	19%	13%

*) In French: *vache laitière*

Table 5 Composition of sample per study location

Size exploitation	Diary cows	Sex	For Fitakimerina	For Iandratsay
≥ 4 ha	> 0	M/F	1	1
< 4 ha	> 0	M	1	1
< 4 ha	> 0	F	1	1
< 4 ha	0	M	4	5
< 4 ha	0	F	3	2
Totaal →			10	10

All the interviewed persons were selected by the vulgarisation agent (technician) at the village. A list from BVPI with persons who practise CA was used to compose the first group. For the two other groups, the agent had a free choice.

4.3 PROGRAMME OF WORK

Activity	**Credits**	**Weeks**	**Data**	**Location**
Proposal	4	3	June	Antananarivo
Preparation fieldwork	14	2	28/06 – 9/07	Antsirabe
Fieldwork		5	12/07 – 13/08	Villages
Analysis		3	16/08 – 3/09	Antsirabe
Reporting	6	4	6/09 – 1/10	Antananarivo
Total	24	17		

5 THEORETICAL FRAMEWORK

This chapter aims to answer the question: Why does CA not work in this region? What are the most important factors that explain the hesitant attitude of farmers towards this system?

Commentaire [M5]: I do not use my own figures for this chapter, it is meant to provide hypotheses, data comes in later.

5.1 THE DISSEMINATION OF CA IN THE RESEARCH ZONES

Information from TAFA and BVPI. Current state of affairs. With a focus on the oats-system.

5.1.1 ORGANISATIONS AND PROJECTS

The NGO TAFA (Tany sy Fampandrosoana) was founded on January 1, 1995. It took over the role of ' Blé Kobama', an organisation that had gone bankrupt. This organization had started working on CA practices (*Système de culture avec couverture permanente des sols et technique de Semis direct*) since 1991, on an experimental farm at Andranomanelatra. When TAFA took over, a start was made with the dissemination of these new techniques. Since 1995, a partnership was formed with FOFIFA. (TAFA-FIFAMOR, 1995)

Also, a national network of institutions was set up, called GSDM: Direct seeding group of Madagascar. Since 2004, GSDM coordinates the project 'Support for the dissemination of agroecological techniques in Madagascar'. This project is funded by AFD and the Malagasy government.

In 2006, the project BVPI SE/HP was started, its full name: *Développement des Bassins Versants et Périmètres Irrigués dans le Sud Est / Hauts Plateaux*. It is part of the national program of BVPI, a policy that was defined by the government. Bidder is the Minister of Agriculture (*Ministère de l'agriculture, de l'élevage et de la pêche*, MAEP). The project is mainly funded by the French agency for development (*Agence Française pour le Développement*, AFD). (BVPI SE/HP Project Team, 2009)

In the past, the BVPI SE/HP project has worked on the infrastructure for irrigation. Operators in the field are SDMAD (Semis Direct Madagascar) and BEST (Abbreviation?). If farmers are part of an association (Organisation Production, OP), they get seeds and entrants which they have to pay back after the harvest. SDMAD is a private company. BVPI first pays the company for the entrants and after the payback of the farmers, SDMAD gives the money again to BVPI. Each region has a technical agent, they are employees of SDMAD. BEST is responsible for the Water User Associations, that group practically all farmers that use the paddy-fields.

Commentaire [M6]: I don't know if I understand it right - farmers use this system only for one year? (because of remark "It provides credit for the first year, relayed further on to local credit organisation (EP)"

In Anjanamanjaka, Ambohimarina and Ampamelonana, the promotion of CA practices started in 2006. Tsaratanana followed in 2007.

The scientific part of the project is carried out by CIRAD (the French international center for agronomic research for development) and FOFIFA (the local research center at Antananarivo University). Since 2001, they are combined in a group (Unité de Recherché en Partenariat, URP) called 'Systèmes de Culture et Rizicultures Durables' (**SCRID**). (CIRAD, 2010)

TAFA has an experimental station in Andranomanelatra (district of Antsirabe II) (Rabary et al., 2008) and historically in Mandoto (add Source). In Fitakimerina and Iandratsay, TAFA does not seem to be very active at farmers' level. They have a reference site at Tsaratanang (Fitakimerina) but that is for fodder, not to demonstrate CA practices.

Box 1: Description of cover crops introduced in the region by BVPI

- Brachiaria (*scientific name*). Newly introduced, farmers discovered that it could be used as fodder, since then exploited for zebu.
- Crotalaire (*scientific name*), weak production of biomass
- Hairy vetch (*Vicia villosa*), used for cattle
- Oats (*Avena sativa*), used for cattle
- New introduction: Éleusine (*scientific name*) (not yet known in the area, same can happen as to Brachiaria?), radis fourrager, cowpeas

5.1.2 EXPERIENCES FROM TAFA

The first diagnostic research in the region was performed in the era of Blé Kobama. It showed that the performance of agricultural activities on *tanety* with acid soils was very poor, with low production levels and labour-intensive practices. (Seguy, 2003:24)

5.1.3 EXPERIENCES FROM BVPI SE/HP

As described above, the project BVPI SE/HP has recently started the introduction of CA practices at the study locations. The CA-systems that are currently used by farmers who are part of the project:

Fitakimerina	**Iandratsay**
Beans + Oats	
Mais + Beans +Oats (Iandratsay: + Potato)	
Beans + Brachiaria	Potato +oats
Cassava + Brachiaria	Potato + Wheat
Pois de terre+Brachiaria	Potato +Vetch (low part)
Pluvial/non-irrigated Rice + Crotalaire	Ray-grass + Vetch
Soja + Brachiaria	Barley + Vetch
Soja + Crotalaire	Beans + Vetch (mainly C2/C3)
Brachiaria/Oats pure	Wheat + Vetch

In the zone of Ikabona, the dissemination of CA practices has not been successful until now. Since the beginning of the project, the cover crops have been removed from the fields, to be used for the cows. The same happened in Fitakimerina, be it not for cattle but to sell the crop residues or exchange it for fertilizer. This happens because the farmers cannot afford chemical fertilizers and they also do not own enough cattle. The farmers of Fitakimerina also prioritize the rice paddies above the *tanety*. According to BVPI SE/HP reporting, adoption of CA practices cannot be expected in these two zones. (Raharison and Andrianaivolala, 2009)

In Iandratsay, the pressure on crop residues is also high. The stalks of the maize are for example used as firewood. But there is a potential for systems that improve the 3-cropping system that is practiced on the *tanety*. In this rotation, oats can be added to provide extra biomass. It will be explained in the next paragraph. (Raharison and Andrianaivolala, 2009)

5.2 TECHNICAL CONSTRAINTS AND OPPORTUNITIES

Options that SCRID can see.

The high altitude of this zone limits the choice for cover crops. The cover crops that are mostly used, do not support the cold temperatures. – to be elaborated

There are not that many leguminosae that grow enough biomass and at the same time are not edible for cattle. – to be elaborated

If soils are more poor, it takes more time to restructure the soil with a cover crop. In combination with the factors that are described below, this can become a problem. (Raharison and Andrianaivolala, 2009:56).

The oats-based system

The most common system that is practiced in Iandratsay, consists of two cycles: Maize and beans in the main season, November to May (C1) and potatoes, barley (orge) or wheat (blé) after the harvest of the beans, April to October (C2). BVPI SE/HP proposes to add oats to this cycle. But when 3 or 4 lines of oats are sowed between the potatoes, it does not produce enough biomass to cover the soil during the whole year. The alternative of hairy vetch (Vicia villosa) needs water during the dry season, so it can only be used on irrigated plots.

For the system to work, the sequence of crops needs to change: Maize and potatoes during C1 and beans with oats in C2. In this way, the oats grows enough to cover the soil. But at the moment, this sequence is not commonly practiced. (Charpentier, 2010)

Where is the oats-system applied? What are the opportunities for this system? (SWOT)

Commentaire [M7]: I will work out these questions and also refer to them in results of survey.

5.3 VIEWS OF FARMERS

5.3.1 CROPS TO COVER OR TO USE ALTERNATIVELY

As noted before, the focus of this research is on the farm and village level. Here an important factor is the trade-off in the allocation of resources (CA2AFRICA, 2009). The fierce competition for crop residues, as described by Giller et al. (2009), also arises here.

For a farmer, there are several possibilities when it comes to using his crop residues. He can use it as feed for his cattle, or as straw which mingles with the cow dung to become fertilizer. He can also burn it to obtain fertile ashes, or compost it. When a farmer implements a CA system, the possibility of leaving the residues on the field is added to these.

Dairy production is an important component of the regional economy. And as land is scarce, every piece of vegetation is preferably used to feed the cows. Farmers even told that, when they decided to leave the plants on their field, someone else stole it (Ahmim-Richard&Bodoy, 2010a). This theft of crop residues is a real problem. It even occurs with living plants, which is the reason why farmers plant the cassava plants very close together. In this way, the roots become deep and difficult to pull out (oral information, O. Husson).

The high pressure on soil resources was also observed in Betafo by Marta Kasprzyk (2008: 43). The dairy farmers work with a “zero-loss” system, in which it is unimaginable to leave crop residues on the field. For these farmers, labour is not expensive so the labour-saving side of CA does not appeal

to them. The systems that have potential should produce more biomass than these farmers are currently experiencing. The amount needed to cover the soil is about 6-7 ton/ha.

BVPI SE/HP identifies this pressure on the use of crops as the main limiting factor for CA practices (Raharison and Andrianaivolala, 2009:56).

In the CA systems, it is also possible to use live crops for coverage of the soil. Mulching of dead plants is better for the soil micro biota, but living cover crops have a higher potential for farmers (Rabary et al., 2008). Quite surprising, the research of Razafimandimby (2007:32) found out that farmers prefer the dead mulch over living cover crops.

5.3.2 AVAILABLE SURFACE TO PERFORM AGRICULTURE

Especially in places with rich soils (like in Iandratsay), the population density is very high. This leads to small parcels, as shown in the figures in §2.1.3. When a farmer has such a limited amount of land, it leads to relatively huge losses if he sets apart some land for a cover crops. The **Brachiaria** needs for example a year of growth to be able to enrich the soil.

5.3.3 FINANCIAL SITUATION

In Antsapanimahazo , most of the farmers that have never tried CA, mentioned the high costs of investment in CA as an obstacle for implementing it. The system requires investment in chemical inputs and specific equipment. These investments will not pay back before several years, and in the first years the revenue from the parcel will be lower than before. For the farmers whose resources are very scarce, it is important to minimize risks. The access to credit does not resolve this, because the interest rates are said to be very high. When comparing different scales of income, it becomes clear that the capacity to bear risks is a determining factor for deciding about CA. Most of the farmers who have practiced CA for 3 years or more, are relatively rich. (Randrianarison et al., 2007)

The lack of money was also the main problem that farmers mentioned in the research of Razafimandimby (2007), conducted in Antsapanimahazo, Ampandrotrarana and Ivory. But this research also concluded that rich landowners do not differ significantly from the average farmer in their willingness to practice CA.

Minimizing risk also often means that farmers prefer a job off-farm above their work at the farm. This does not automatically lead to abandoning of CA practices, but Randrianarison et al. (2007) found that it did happen, especially when the father of the family was working off-farm. This leads to the question why their wives apparently decided to abandon CA.

Households with a small amount of available labour and small capital availability to employ additional labourers, could profit from CA practices because it often requires less labour. But the figures on this are not very convincing. (Razafimandimby, 2007:32)

Another important factor is the type of tenure. The poor farmers often rent the land, with contracts that are just valid for several years. This is another reason why long-term investments are probably not advantageous for them. (Randrianarison et al., 2007)

For those who do not own the land, it is even very risky to improve the quality of their soils through CA. In this way, the value of the parcel will increase and the owner can take it back or increase the rent.

5.3.4 *EXPERIENCE WITH THE PROJECT*

Farmers that have never tried to implement CA, are often under informed about the system. Witnessing other people abandon CA is also a reason to stay away from it.

In cases where people have tried CA but abandoned it after some time, the organization of the dissemination turned out to be problematic. Credit can only be obtained when one is a member of a farmer's association (*association d'agriculteurs*). There is a lot of critique on these organizations. Complaints are about the delivery of inputs and material, that is often late. (Randrianarison et al., 2007)

TAFA offers no assurance if the harvest is lost, which can happen through natural causes. Razafimandimby (2007:32) concludes that the credit system should become less rigid, to enable more farmers to profit from it.

5.4 CONCLUSION: HYPOTHESES

With this information from different resources, we return to the questions: Why does CA not work in this region? What are the most important factors that explain the hesitant attitude of farmers towards this system? A summary of the constraints that follow from experiences of BVPI, SCRID, TAFA and research of farmers' preferences, in order of importance:

- competition for biomass between CA practices (mulch in the fields) and livestock feeding requirements.

- system with no resistance of cover crops to coldness

- are intensive crop rotation systems a constraint to integrate a covercrop ???

- farm size too small to integrate a non productive crovercrop

- others

The hypotheses that are tested in the survey:

- Having cattle or not makes not that big a difference – residues are also sold.
- The size of the farm (more land exploited, more cattle, more income) has a positive effect on adoption of CA?
- Crops on rizière represent big(gest) share of agricultural activity (measure time spend on it): Less motivated for CA
- Soil type: poor soils take more time to be restructured, but rich soils are also not favorable for CA because there is a lot of pressure on the parcels. ??
- If the workload of women gets more heavy with CA practices, they are more inclined to decide against CA.

6 RESULTS OF SURVEY

Commentaire [M8]: Very sketchy, only first thoughts.

6.1 TABLES WITH RESULTS AND ANALYSIS

See other Word Document:

- Farm typology
- Resources of households
- Utilization of resources
- Perception of conservation agriculture

6.2 DISCUSSION

Answer to hypotheses: why non-adoption?

In *Chapter 5: Theoretical synthesis*, the hypotheses come up with these most important parameters that could explain the non-adoption of CA:

- Having cattle or not makes not that big a difference – residues are also sold.
- The size of the farm (more land exploited, more cattle, more income) has a positive effect on adoption of CA?
- Crops on rizière represent big(gest) share of agricultural activity (measure time spend on it): Less motivated for CA
- Soil type: poor soils take more time to be restructured, but rich soils are also not favorable for CA because there is a lot of pressure on the parcels. ??
- If the workload of women gets more heavy with CA practices, they are more inclined to decide against CA.

Elaborate on oats-based system and the 9 farmers that have actually described a CA system that they practiced.

Is CA helpful for people with little labour and money available?

Thoughts:

It is expensive to cultivate during contre-saison (remark by no 21), this is why not all farmers do it.

Rice is source of liquidity, sold when people need money to repair their house or to pay salaries.

Depenses become smaller with CA, mainly because of the less hired labour that is needed to plough the soil.

It seems that CA practices are extension-intensive. Farmers think it will not work without a lot of attention from SDMAD-employees.

Farmers have only very recently started trying CA practices (since 2006). No one really practices it on a significant scale.

The rain is very important, for cultivating in main season farmers have to wait for the rain.

Reforestation with Eucalyptus is more popular, many trees planted. Was also programme of SDMAD, many farmers told that they have participated and mention it as a way to protect the soil and the environment.

Within definition of FAO, emphasis lies on covering the soil. Farmers did not mention rotation as part of SCV, and they often view paillage in combination with tillage as CA.

6.3 Discussion of method

This paragraph will explain the choices that were made in treating the data. It will also criticize the method that has been followed and suggest alternatives.

Used figures

For labour availability, children that go to school are not considered. Those that are not at school are counted 0,5 if they are 10-15 years old. People older than 60 are also counted 0,5.

Unité Animale

Self sufficiency in rice is defined as: The household eats rice for at least 8 months a year. It is calculated as follows: [(Number of are paddy) x (Average yield per are)] / [(Number of persons at charge) x (Per capita rice consumption for eight months)]. In this way, an outcome ≥ 1 indicates that the household is self sufficient in rice.

The **per-capita** consumption of rice is estimated at 250 kg paddy/year.

Sources of inaccuracy

The surface of the parcels is determined by the number of planting women. The estimation of BVPI is that 1 woman can plant 1,5 are. In

Because of an [aanvankelijk] different understanding of the term 'self sufficiency in rice', the total production of rice was not asked in the survey. In order to apply to the definition of BVPI, this figure had to be calculated from the surface of paddy fields and the average yield, which does not make it very precise.

Because the survey did not include the difference between well- and poorly managed parcels (RMME= rizières à mauvaise maîtrise de l'eau), the average yield of the paddy fields is a very rough estimate. Rakotofiringa and Tokarski (2007) mention a average yield for irrigated rice of 3265 kg/ha for the village of Andranomanelatra (north of Antsirabe). It appears that this counts for the well-managed paddy fields. In the research of Ahmim-Richard and Bodoy (2010a), figures vary according to the different types of farmers: 2 (type 1), 2,5 (type 5), 3 (type 4) or 3,2 (type 3) ton/ha.

BVPI SE/HP (2009a) mentions 3 ton/ha for irrigated rice (well-managed) in the highlands but has no figures for RMME in this region. In the South-East region it ranges from 0,53 to 1,72 ton/ha.

It is not clear which part of the paddy fields can be qualified as RMME. The location of Fitakimerina reports 30% of the paddy-fields well-irrigated and 70% poorly irrigated (BVPI SE/HP, 2008a :2), but this does not necessarily mean that 70% of the fields are RMME. In general, the area of Iandratsay seems to have no RMME at all (BVPI SE/HP, 2009a:52).

Commentaire [M9]: Or does it? I am not sure.

Considering all this, the average yield of the paddy fields was estimated to be 2,5 ton/ha in Iandratsay and 2 ton/ha in Fitakimerina. To account for losses during harvest and storage (10%) the figures that are used are 22,5 kg/are and 18 kg/are.

Soil types- better take pictures of defined soil types (or samples) and let them choose.

Social factors

Everyone who has never practiced, says he/she want to start with CA. Most probably caused by their perception of the interview – vulgarisation agents who can provide them with seeds and entrants. It is difficult, even impossible, to judge if people tell their true thoughts about CA or if they tell a story to receive the things that they want to get.

Determining sample: Techniciens too influential.

Discussion of typology

It is said that type 5 occurs only in the Middle-West, but this type is also present in the highlands.

7 CONCLUSION

No new information. Including recommendations

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